Hardware and Engineering

XI/OC Signal Modules

05/02 AWB2725-1452GB

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Warning!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).

Contents

About this Manual

This manual describes the XIOC signal modules for the expandable PLC types XC-CPU100/200/400/600. In Chapter 1 you will find information on mounting and wiring, which is applicable to all the signal modules. Chapter 4 provides comprehensive technical data. This chapter also starts with a general section. Specific features are then dealt with separately or, there where it is more useful, combined in groups. Chapter 2 and Chapter 3 include further detailed information on the temperature acquisition module and the counter module.

Additional manuals

The PLC types that are used in conjunction with the signal modules are described in the following manuals:

PLC type	Manual no.	Article no.
XC-CPU100/200	AWB2724-1453GB	
XC-CPU400/600	AWB2700-1428GB	

These manuals are also available online as PDF files, under "www.moeller.net → support". Enter the manual number here as the search text.

Intended users

Read this manual carefully, before you install the signal module and start using it. We assume that you are familiar with basic physical concepts and are experienced in reading technical drawings and dealing with electrical equipment.

Abbreviations and symbols

The abbreviations and symbols used in this manual have the following meanings:

I/O	Input/Output
PLC	Programmable Logic Controller
I_o	Input current
I_1	Output current
U_o	Input voltage
U_1	Output voltage

All dimensions are in millimetres, unless otherwise specified.

▶ Indicates instructions on what to do

→ Draws your attention to interesting tips and supplementary information

▽ **Important!**
Indicates the risk of minor material damage.

⚠ **Caution!**
Indicates the risk of major damage to property, or slight injury.

⚠ **Warning!**
Indicates the risk of major damage to property, or serious or fatal injury.

For greater clarity, the chapter title is shown at the top left of the page, and the current section at top right. Exceptions are the first page of each chapter, and empty pages at the end.

1 Signal modules

Overview

The signal modules for the expandable PLC types XC-CPU100/ 200/400/600 are divided into:

- Digital input/output modules
- Analogue input/output modules
- Function modules, such as counter and network modules

The following table provides an overview of the modules.

Table 1: List of signal modules

Designation	Type	Technical data
Module rack	XIOC-BP-XC	For CPU with power supply
	XIOC-BP-XC1	For CPU with power supply, 1 signal module
	XIOC-BP-2	For 2 signal modules
	XIOC-BP-3	For 3 signal modules
Digital input module	XIOC-8DI	8 channels, 24 V DC
	XIOC-16DI	16 channels, 24 V DC
	XIOC-16DI-AC	16 channels, 200 to 240 V AC
Digital output module	XIOC-8DO	8 channels, transistor output 12/24 V DC (source type)
	XIOC-16DO	16 channels, transistor output 12/24 V DC (source type)
	XIOC-16DO-S[1)]	16 channels, transistor output 12/24 V DC (source type)
	XIOC-12DO-R	12 channels, relay output
Analogue input module	XIOC-8AI-I2	Current input (channels 0 to 7) 4 to 20 mA, 12 bit
	XIOC-8AI-U1	Voltage input (channels 0 to 7) 0 to 10 V DC,12 bit
	XIOC-8AI-U2	Voltage input (channels 0 to 7) –10 to +10 V DC,12 bit
	XIOC-4T-PT	Pt100/1000 input (channels 0 to 3) 15 bit, signed
Analogue output module	XIOC-2AO-U1-2AO-I2	Voltage output (channel 0 + 1) 0 to 10 V DC, current output (channel 2 + 3) 4 to 20 mA, 12 bit
	XIOC-2AO-U2	Voltage output (channel 0 + 1) –10 to 10 V DC
	XIOC-4AO-U2	Voltage output (channels 0 to 4) –10 to 10 V DC
	XIOC-4AO-U1	Voltage output (channels 0 to 4) 0 to 10 V DC
Counter module	XIOC-1CNT-100kHz	Input for fast counter, maximum frequency 100 kHz, 1 channel, switchable 1/2-phase, 2 open-collector outputs
	XIOC-2CNT-100kHz	Input for fast counter, maximum frequency 100 kHz, 2 channels, switchable 1/2-phase, 2 open-collector outputs per channel

1) With short-circuit protection

Accessories

Designation	Type	Comments
Spring-loaded terminal	XIOC-TERM-18T	For digital and analogue I/O modules
Screw terminals	XIOC-TERM-18S	

Assembly

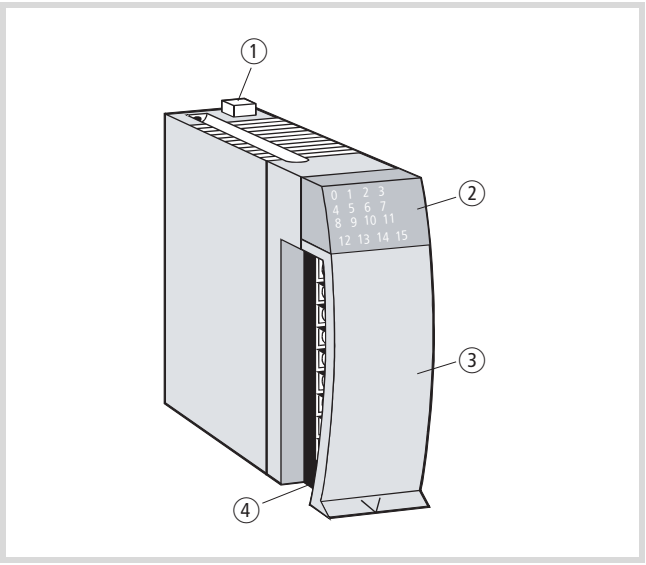


Figure 1: Assembly of a signal module

① Catch
② LED display
③ I/O cover
④ Terminal block

PLC connection

The XIOC modules are the I/O modules for the PLC types XC-CPU100/200/400/600. The following diagrams show the assembly of XIOC modules connected to a PLC.

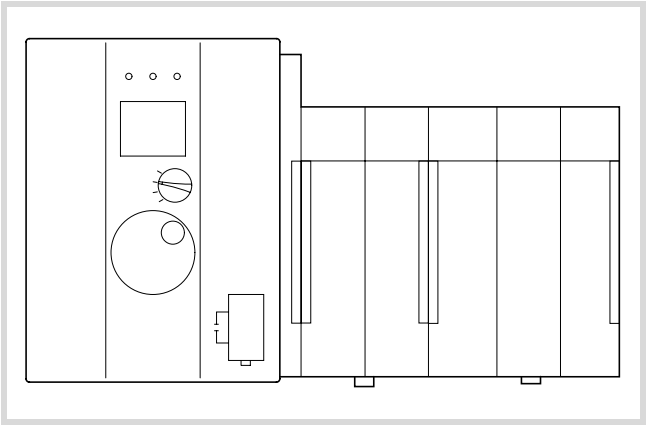


Figure 2: XC-CPU400/600 with XIOC signal modules

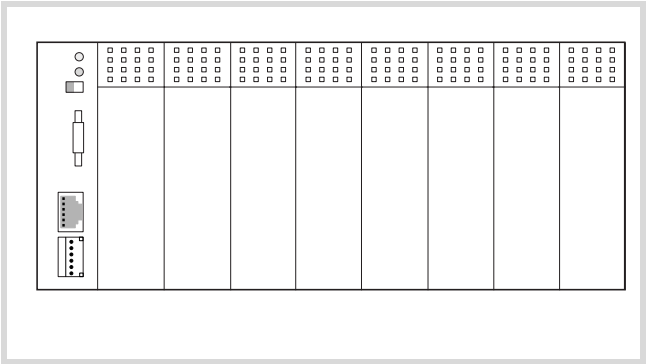


Figure 3: XC-CPU100/200 with XIOC signal modules

Slot assignment in the module racks

The XIOC modules are plugged onto module racks that provide the connection to the PLC. The modules are also interconnected through the module rack.

The integrated bus system ensures interference-free transmission between the individual slots on the bus. In addition, the bus system supplies the individual modules with the voltage that is required for internal signal processing.

The supply voltage for the I/O electronics is applied directly to the corresponding I/O modules.

Four different module racks are available:

Table 2: Slot assignment in the module racks

Module rack	Slots		
	1	2	3
XIOC-BP-XC (Basic module rack)	CPU with power supply		–
XIOC-BP-XC1 (Basic module rack)	CPU with power supply		I/O module
XIOC-BP-2 (Expansion module rack)	I/O module		–
XIOC-BP-3 (Expansion module rack)	I/O module		

As a rule, the first module rack, which is used to take the CPU type XC-CPU100/200, is a basic module rack. You can add on several expansion module racks to the right side. The module racks must be arranged so that one CPU module and a maximum of 7 XIOC signal modules can be planned (→ fig. 4).

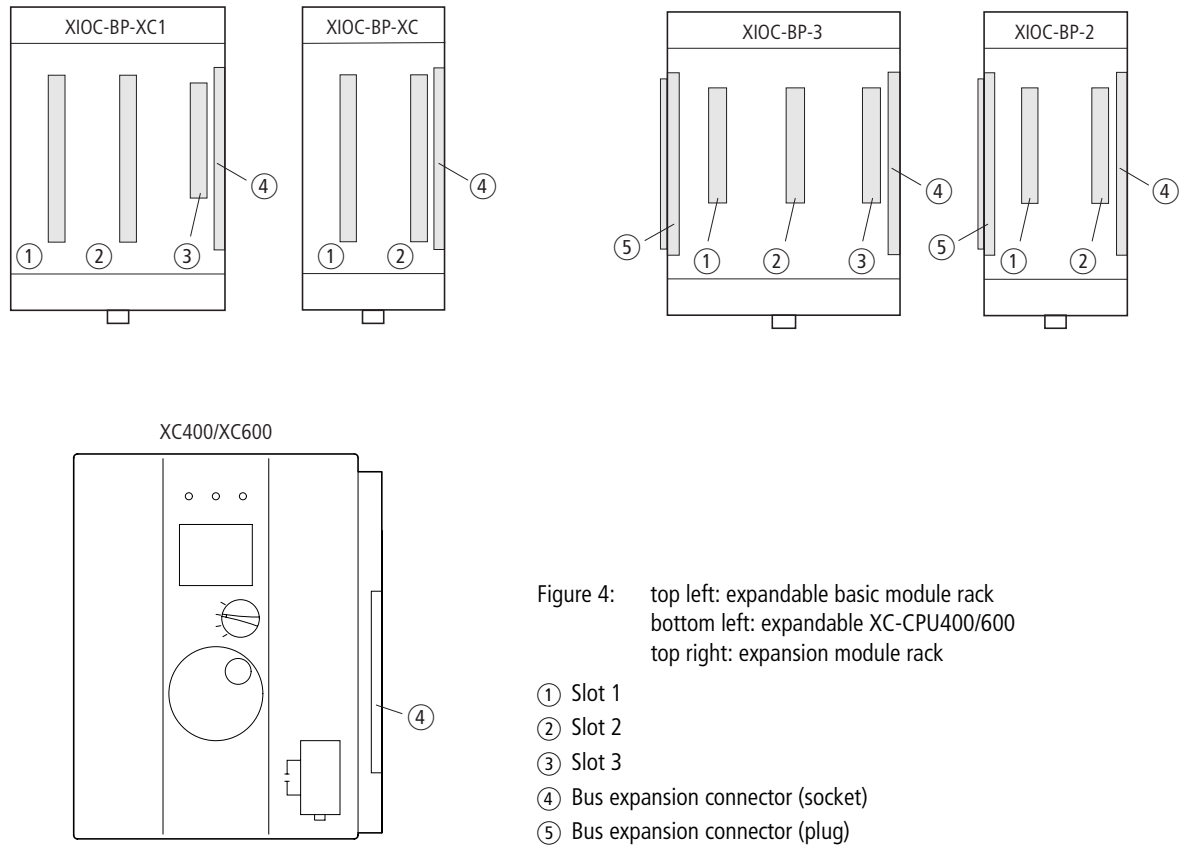


Figure 4: top left: expandable basic module rack
bottom left: expandable XC-CPU400/600
top right: expansion module rack

① Slot 1
② Slot 2
③ Slot 3
④ Bus expansion connector (socket)
⑤ Bus expansion connector (plug)

Mounting the module rack

The module rack can either be snapped onto a top hat (DIN) rail, or screwed directly onto the mounting plate.

⚠ **Caution!**
The expansion module rack must only be plugged in or pulled out when the power is switched off. FIrst detach the CPU or I/O modules that were plugged into the module rack. Discharge yourself from any electrostatic charge before touching electronic modules. Voltage peaks on the bus connector may cause malfunction or damage to the modules.

→ Read the manual AWB2700-1428D for information on mounting the XC-CPU400/600, and manual AWB2724-1453D for the XC-CPU100/200.

Mounting on the top hat rail

- ▶ Use a screwdriver to pull out the locking bar until the catch snaps into position. The locking bar is then held in this position [1] .
- ▶ Place the module rack on the top hat mounting rail so that the top edge of the rail fits into the slot, and then slide the module rack into the correct position [2].
- ▶ Press down the catch of the locking bar. The bar snaps in behind the edge of the mounting rail. Check that the module rack is firmly seated [3].
- ▶ If you want to fit an expansion module rack: push it to the left, until the bus connector of the expansion module rack can be plugged into the bus connector socket of the XC-CPU400/600 or the basic or expansion module rack. Take care that the bus connectors of the module racks are completely engaged, in order to ensure reliable electrical contact.

Mounting on the mounting plate

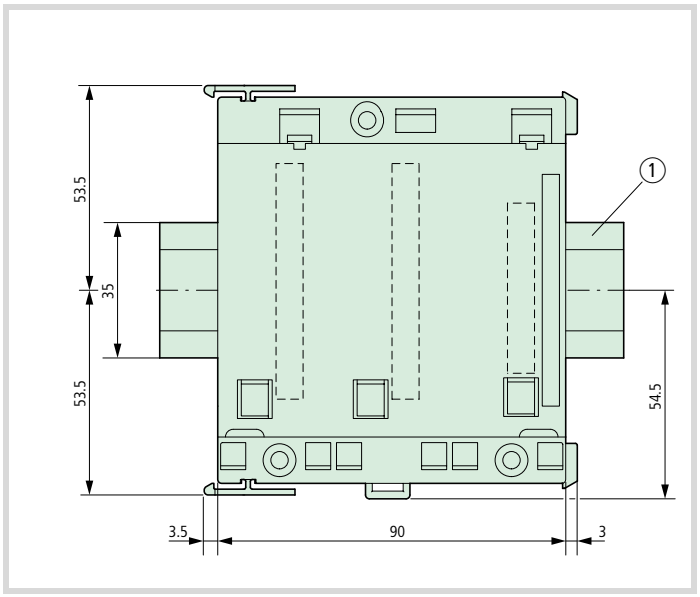
The spring contacts that protrude from the back of the module rack are intended to provide a ground for the modules. They must have a reliable electrical contact with the mounting plate.

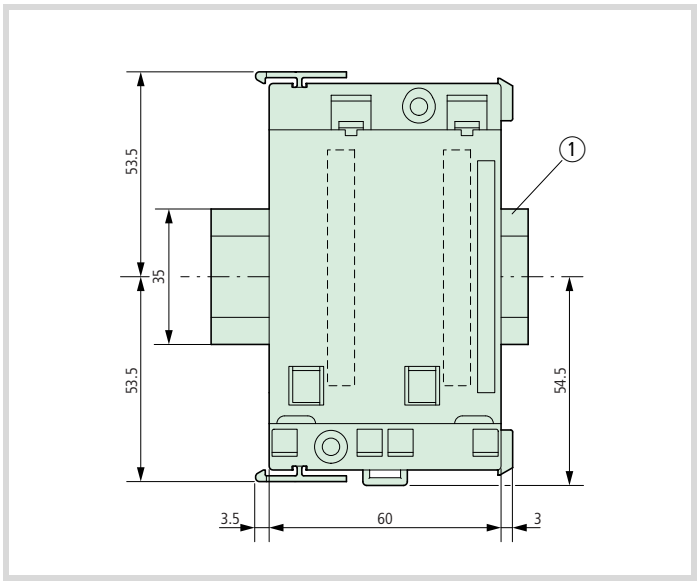
Take care that the contact areas are protected from corrosion and – if you are using painted mounting plates – that the paint layer is removed from the contact areas.

- ▶ Plug the bus connector of the expansion module rack into the bus connector of the XC-CPU400/600 or the basic or expansion module rack. Take care that the bus connectors of the module racks are completely engaged, in order to ensure reliable electrical contact.

Detaching the module rack

- ▶ Use a screwdriver to pull out the locking bar until the catch snaps into position. The locking bar is then held in this position [1] .
- ▶ Only with expansion module racks: Slide the expansion module rack along the top hat rail to the right, until the bus connectors are disengaged.
- ▶ Take the module rack off the rail.





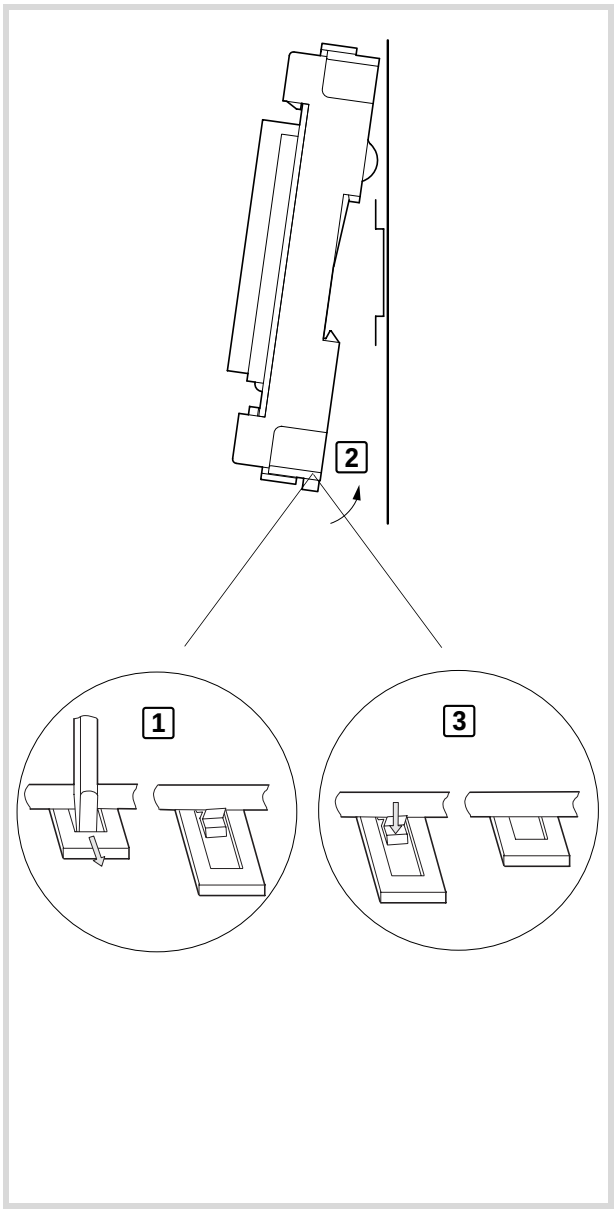


Figure 5: Mounting on a 35 mm top hat (DIN) rail,
top left: XIOC-BP-XC1, (XIOC-BP-3)
bottom left: XIOC-BP-XC, (XIOC-BP-2)

① 35 mm top hat rail

See also dimensions on Page 14.

Mounting the signal modules

- ▶ Insert the loop on the bottom of the module into the hole in the module rack [1].
- ▶ Press the top of the module onto the module rack, until you hear it click into position [2].

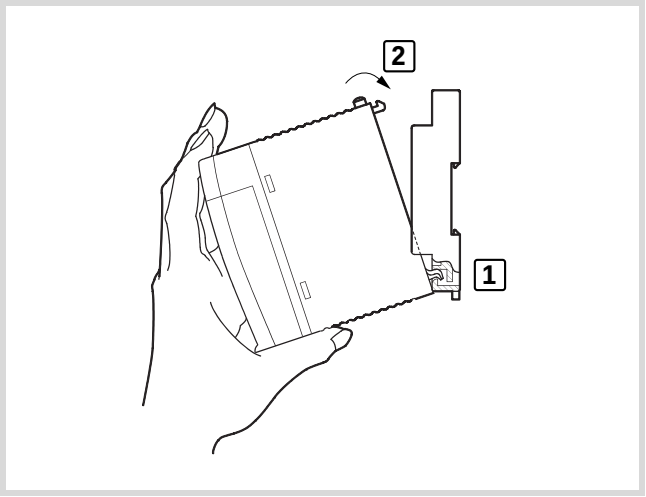


Figure 6: Mounting the signal modules

Detaching the signal modules

- ▶ Press in the catch [1].
- ▶ Keep the catch pressed in and pull the top of the module forwards [2].
- ▶ Lift up the module and remove it [3].

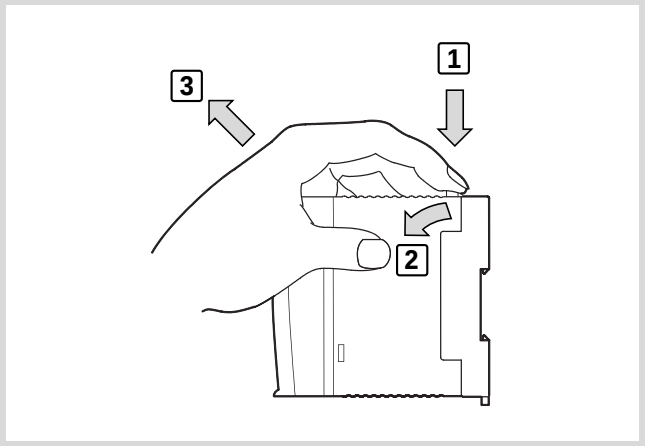


Figure 7: Detaching the modules

Fixing the terminal block

- ▶ Plug the lower end of the terminal block onto the module board. Screw in the fixing screw a short way [1].
- ▶ Push the top end of the terminal block onto the module, until you hear it snap into position [2].
- ▶ Hold the top end of the terminal block firmly, and tighten up the fixing screw [3].
- ▶ Tug on the top end of the terminal block, to check that it is firmly seated and cannot come loose [4].

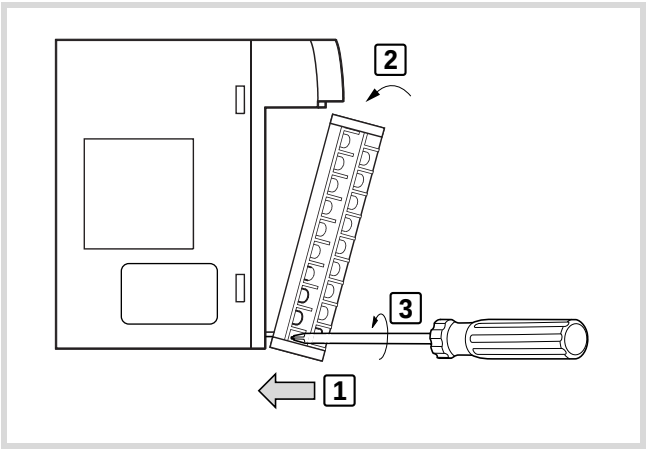


Figure 8: Fixing the terminal block

Wiring up the I/O signals

Wiring up the screw terminal block

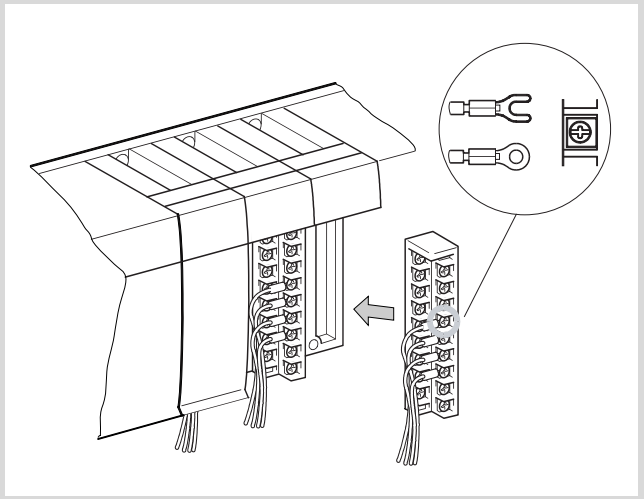


Figure 9: Wiring up the screw terminal block

→ Please observe the following notes:

- All terminals have M3 screws.
- Tighten up the screws to a torque of 0.49 to 0.78 Nm.
- If cable lugs are to be used, then they must have a maximum outside diameter of 6 mm.
- Do not attach more than 2 cable lugs to one terminal.
- Use a cable with a maximum conductor cross-section of 0.75 mm^2, or 0.5 mm^2 if two cable lugs are going to be fixed to the same terminal.

Wiring up the spring-loaded terminal block

The spring-loaded terminal block has the same basic design as the screw terminal block. The difference lies in the way the cable is connected.

Table 3: Cable connection

Conductor	Screw connection	Spring-loaded connection
solid core	0.5 to 2.5 mm^2	0.34 to 1.0 mm^2
stranded, with bootlace ferrule	0.5 to 1.5 mm^2	0.14 to 1.0 mm^2

Wiring the digital input module (24 V DC)

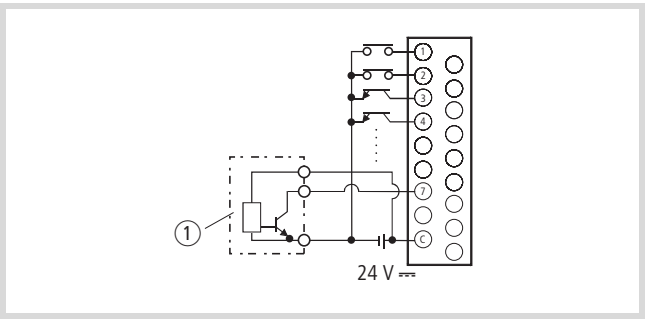


Figure 10: Example of external wiring for the DC input XIOC-8DI/ 16DI (here 16 DI)

① Proximity switch

- The diodes that are connected in antiparallel to the input circuits of the module enable operation of the inputs from either +24 V DC or –24 V DC (see „Internal circuit“ on Page 24).
- When an ON signal is applied to all inputs, the current drawn via the input contacts is typically 6.9 mA (XIOC-8DI) or 4 mA (XIOC-16DI).
- Sensors, such as proximity sensors or photoelectric switches, can be directly attached, provided that they are current-sinking types (open-collector). Sensors that have a voltage output must be connected to the inputs via transistors.
- Use cables with a maximum length of 30 metres.

Wiring up the digital output module (24 V DC)

Wiring up the relay output module

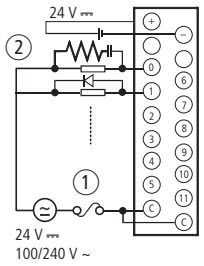


Figure 11: External wiring of the relay output XIOC-12DO-R

① Fuse

② RC peak-suppression filter or diode

RC peak-suppression filter

▶ When an inductive load is present, wire an RC peak-suppression filter (capacitor 0.1 µF and resistor about 100 Ω) parallel to the load. For DC loads, free-wheel diodes must be used.

Fuse

▶ There is no fuse inside the module. Fit a 6 A fuse in the circuit (common) to protect the external wiring from being burnt out.

Supply voltage for relay operation

▶ Observe the polarity of the 24 V DC connection. Incorrect wiring can damage the internal circuitry.

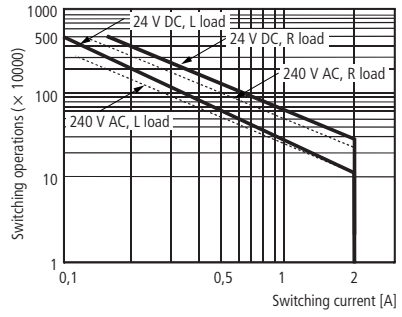


Figure 12: Operating life diagram for the relay contacts

The operating life of a contact is inversely proportional to the square of the current. Any overload currents that occur, or directly connected capacitive loads, can therefore drastically reduce the operating life of a relay.

The transistor output module is to be preferred for high-frequency switching operations.

Wiring up the transistor output module

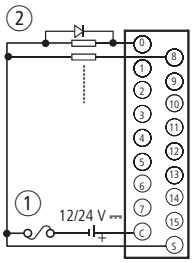


Figure 13: External wiring of the transistor output XIOC-8DO/-16DO (positive logic, source type)

① Fuse

② Diode

Free-wheel diode

▶ When using inductive loads,connect a free-wheel diode in parallel.

S and C terminals

Always connect up the S and C terminals. If the module is operated without these terminals being connected, then the free-wheel diodes cannot carry out their function, and there is a danger that the module will not function correctly, or may even be damaged.

Fuse

A fuse is wired into the common current path, to prevent the external wiring from being burnt out, but it cannot protect the transistors. The transistors can, therefore, be destroyed by a short-circuit of the external load.

If the fuse has blown, then no output signals can be produced, even though the LED is lit up.

Caution!
When the blown fuse has been replaced, do not switch on the power to the module again, until you have found and removed the cause of the fault.

Wiring up the analogue module

- ▶ Short-circuit any unused channels on the analogue input module.
- ▶ Short-circuit any unused current outputs on the analogue output module (2 to 3 channels).
- ▶ Only use shielded cables for connection to external equipment.
- ▶ Route the cables separately from power leads or signal cables that carry differential voltages.
- ▶ Depending on the prevailing electromagnetic environment, one or both ends of the shielding should be grounded.
- ▶ Lay the AC supply power cables in separate ducts to those used for signal or data cables.
- ▶ Lay signal and data cables as close as possible to the grounded surfaces of the switchgear cabinet.

Project planning

Details on project planning can be found in the following manuals

XC-CPU400/600: AWB2700-1428

XC-CPU100/200: AWB2724-1453

Dimensions

Signal modules

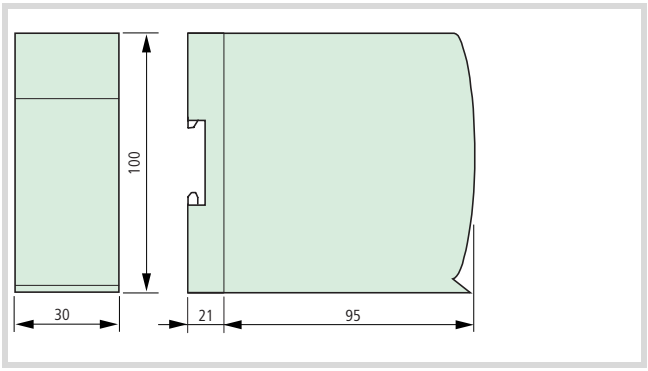


Figure 14: Dimensions of the signal modules

Module rack

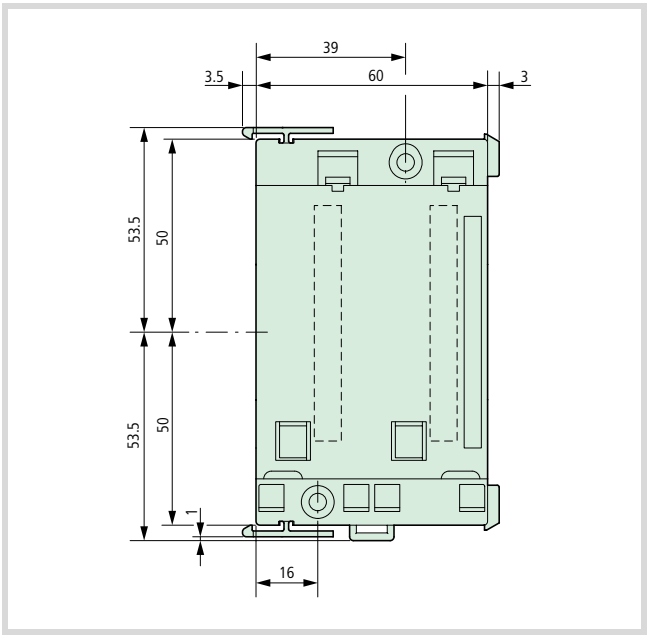


Figure 15: Dimensions of the module racks XIOC-BP-XC, XIOC-BP-2

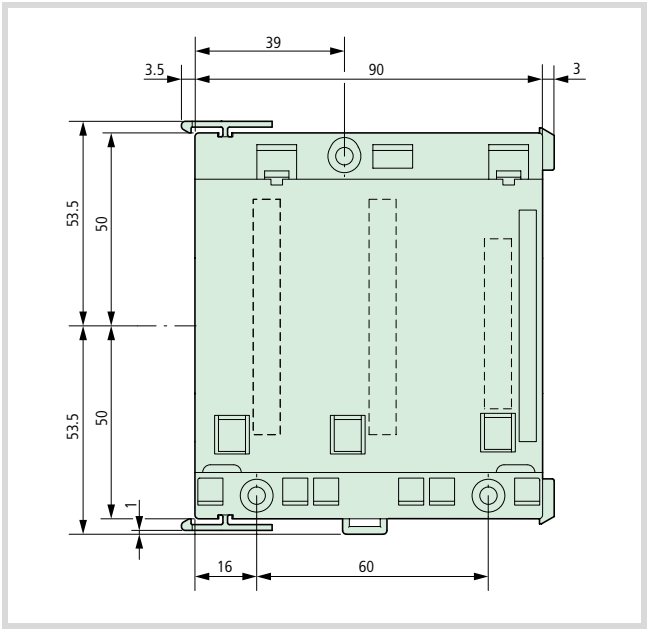


Figure 16: Dimensions of the module rack XIOC-BP-XC1, XIOC-BP-3

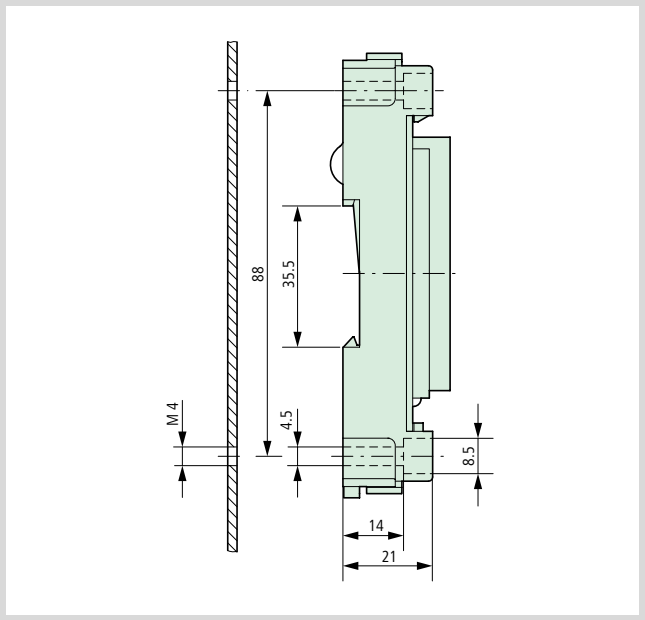


Figure 17: Dimensions of the module racks

2 Temperature acquisition module XIOC-4T-PT

Features

Pt100 (IEC751) and Pt1000 resistance thermometers can be connected to the XIOC1000T-PT temperature acquisition module.

Three temperature ranges are available, that can be selected via DIP switches.

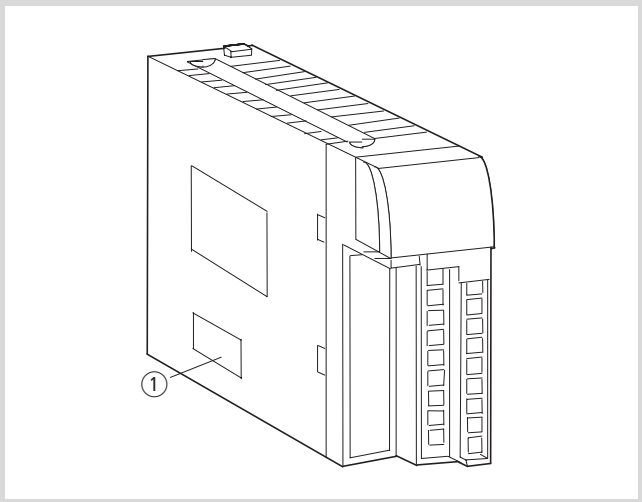
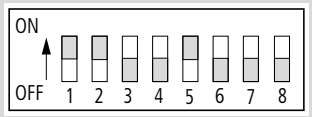
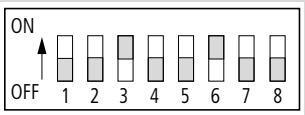
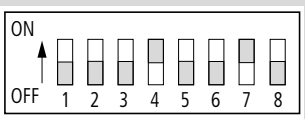


Figure 18: DIP switch position for temperature setting

① DIP switch

Table 4: Setting the temperature range

Type of resistance thermometer	Temperature measurement range (°C)	Accuracy (°C)	DIP switch
Pt100	–20 to + 40	± 0.5	 1, 2, 5 = ON
Pt100	–50 to + 400	± 3	 3, 6 = ON
Pt1000	–50 to + 400	± 6	 4, 7 = ON

Wiring

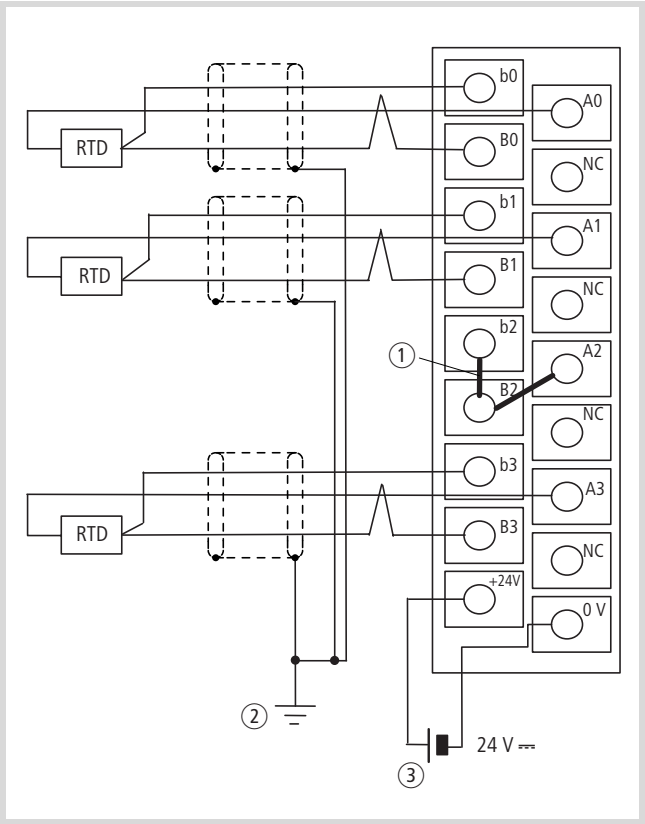


Figure 19: Wiring example

① Join the terminals of unused inputs (b2-B2-A2 in the diagram). Unused inputs have an indefinite status. The value is $7FFF_{hex}$.

② The shielding of the cable can be grounded at one or both ends, depending on the interference situation.

③ External supply voltage, 24 V DC

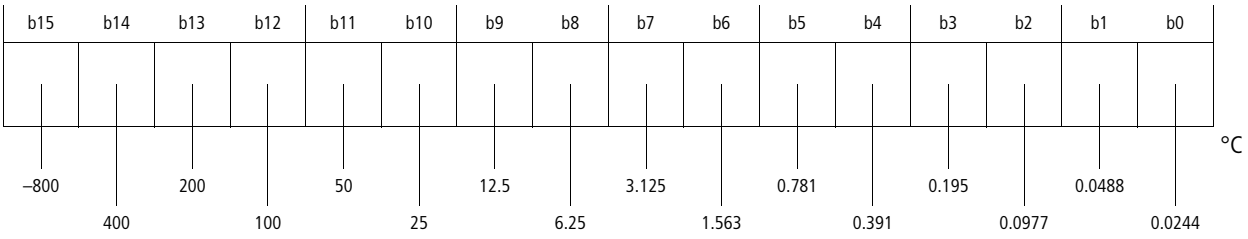
RTD = Resistance Temperature Detector

NC = Not connected/unused

Data evaluation

Range 1: –50 to +400 °C (Pt100/Pt1000)

The temperature is converted into a signed 15 bit value. The weighting of the bits can be seen in the following diagram.



Example 1

$F800_{hex}$ = 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0

F_{hex} 8_{hex} 0_{hex} 0_{hex}

If you enter these bit values in the table above, the result is the following value:

–800 + 400 + 200 + 100 + 50 = –50 °C

Example 2

0600_{hex} = 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0

0_{hex} 6_{hex} 0_{hex} 0_{hex}

25 + 12.5 = 37.5 °C

If the measured value for the temperature lies outside the range (< –51 °C or > 410 °C), then the data value is displayed as $7FFF_{hex}$.

The relationship between temperature and the measured value is shown by the following equation and the diagram.

$$\text{Temperature (°C)} = \frac{\text{Decimal value, e.g. 256 } (0100_{hex})}{40.96} = 6.26\ (°C)$$

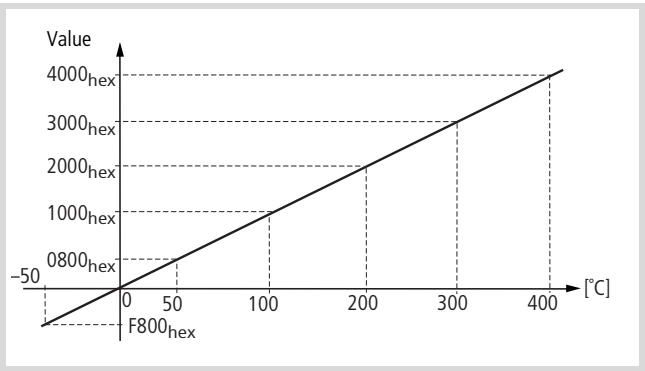
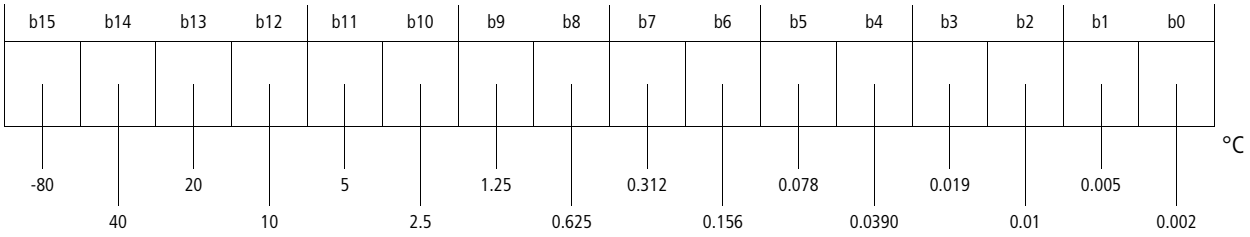


Figure 20 : Temperature/measurement diagram

Range 2: –20 to +40 °C (Pt100)

The temperature is converted into a signed 15 bit value. The weighting of the bits can be seen in the following diagram.



Example 1

$E000_{hex}$ = 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

E_{hex} 0_{hex} 0_{hex} 0_{hex}

If you enter these bit values in the table above, the result is the following value:

–80 + 40 + 20 = –20 °C

Example 2

0600_{hex} = 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0

0_{hex} 6_{hex} 0_{hex} 0_{hex}

2.5 + 1.25 = 3.75 °C

If the measured value for the temperature lies outside the range (< –25 °C or > 45 °C), then the data value is displayed as $7FFF_{hex}$.

The relationship between temperature and the measured value is shown by the following equation and the diagram.

$$\text{Temperature (°C)} = \frac{\text{Decimal value, e.g. 256 } (0100_{hex})}{409.6} = 0.626\ (°C)$$

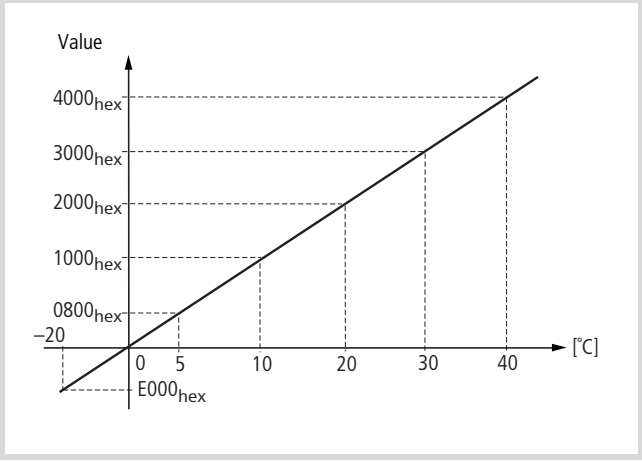


Figure 21 : Temperature/measurement diagram

Conversion tables

Table 5: Conversion table for Pt100 (–20 to +40 °C)

Temperature (°C) 1)	Decimal value	Hexadecimal value	Pt100 resistance (Ω)
-25	55296	D800	90.19
-20	57344	E000	92.16
-15	59392	E800	94.12
-10	61440	F000	96.09
-5	63488	F800	98.04
0	0	0000	100.00
5	2048	0800	101.95
10	4096	1000	103.90
15	6144	1800	105.85
20	8192	2000	107.79
25	10240	2800	109.73
30	12288	3000	111.67
35	14336	3800	113.61
40	16384	4000	115.54
45	18432	4800	117.47

1) The technical data refer to the range from –20 to 40 °C.

Table 6: Conversion table for Pt100/Pt1000 (–50 to +400 °C)

Temperature (°C)[1]	Decimal value	Hexadecimal value	Pt100 resistance (Ω)[2]
-60	63078	F666	72.33
-55	63283	F733	78.32
-50	63488	F800	80.31
-45	63693	F8CC	82.29
-40	63898	F999	84.27
-35	64102	FA66	86.25
-30	64307	FB33	88.22
-25	64512	FC00	90.19
-20	64717	FCCC	92.16
-15	64922	FD99	94.12
-10	65126	FE66	96.09
-5	65331	FF33	98.04
0	0	0000	100.00
5	205	00CC	101.95
10	410	0199	103.90
15	614	0266	105.85
20	819	0333	107.79
25	1024	0400	109.73
30	1229	04CC	111.67
35	1434	0599	113.61
40	1638	0666	115.54
45	1843	0733	117.47
50	2048	0800	119.40
55	2253	08CC	121.32
60	2458	0999	123.24
65	2662	0A66	125.16
70	2867	0B33	127.07
75	3072	0C00	128.98
80	3277	0CCC	130.89
85	3482	0D99	132.80
90	3686	0E66	134.70
95	3891	0F33	136.60
100	4096	1000	138.50
110	4506	1199	142.29
120	4915	1333	146.06
130	5325	14CC	149.82
140	5734	1666	153.58
150	6144	1800	157.31
160	6554	1999	161.04
170	6963	1B33	164.76
180	7373	1CCC	168.46
190	7782	1E66	172.16
200	8192	2000	175.84
210	8602	2199	179.51
220	9011	2333	183.17
230	9421	24CC	186.82
240	9830	2666	190.45
250	10240	2800	194.07
260	10650	2999	197.69
270	11059	2B33	201.29
280	11469	2CCC	204.88
290	11878	2E66	208.45
300	12288	3000	212.02
310	12698	3199	215.57
320	13107	3333	219.12
330	13517	34CC	222.65
340	13926	3666	226.17
350	14336	3800	229.67
360	14746	3999	233.17
370	15155	3B33	236.65
380	15565	3CCC	240.13
390	15974	3E66	243.59
400	16384	4000	247.04
410	16794	4199	250.48

1) The technical data refer to the range from –50 to +400 °C for the Pt100

2) Resistance value Pt1000 = 10 × resistance value Pt100

Fault-finding

The following list describes some types of fault and advice on removing them.

Faults that affect a single channel

If the measurement is unstable, does not meet the specified accuracy, or indicates the value $7FFF_{hex}$:

- ▶ check that the wiring is correct for the channel that shows the error
- ▶ check whether the cable from the sensor to the module runs close to mains power supply cables
- ▶ check that the terminal connection is firmly seated
- ▶ check that the data for the Pt100/1000 that is used conform to IEC751
- ▶ check the resistance of the external wiring ($< 400\ \Omega$)
- ▶ check that the temperature to be measured lies within the range of the XIOC-4T-PT.

Faults that affect more than one channel

All channels indicate the value $7FFF_{hex}$:

- ▶ check that the external supply voltage is properly connected
- ▶ check whether the load capability of the external supply is adequate ($\geqq 1$ A).

3 Counter module

Wiring of the counter module

Connect the incremental encoder to the counter input

The counter module has an input circuit that permits the connection of various types of incremental encoder. The encoder that is connected can have a differential output or an open-collector output. The following examples illustrate the various connection options.

Two incremental encoders

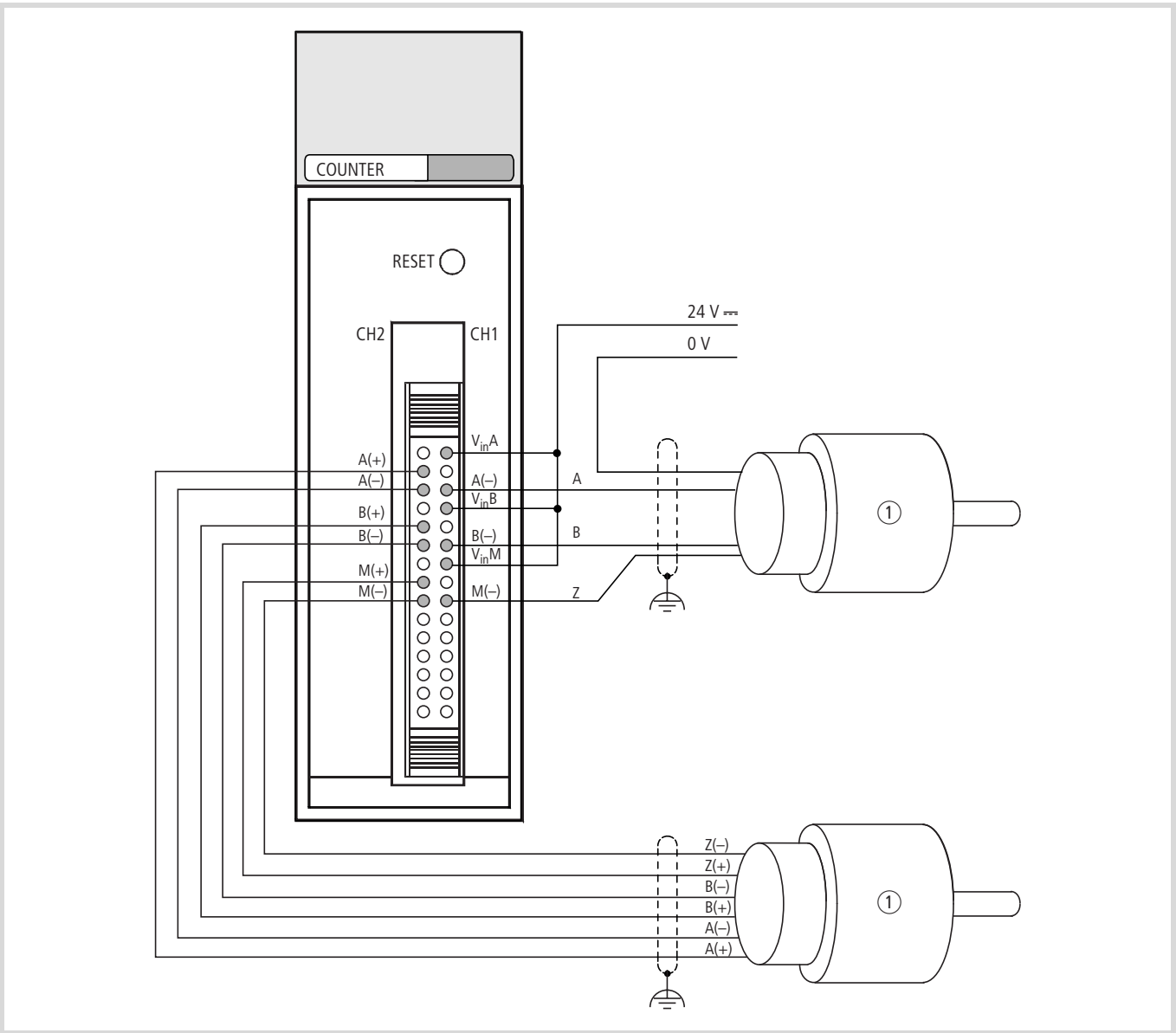


Figure 22: Connection for 2 incremental encoders (example)

Incremental encoder with differential output

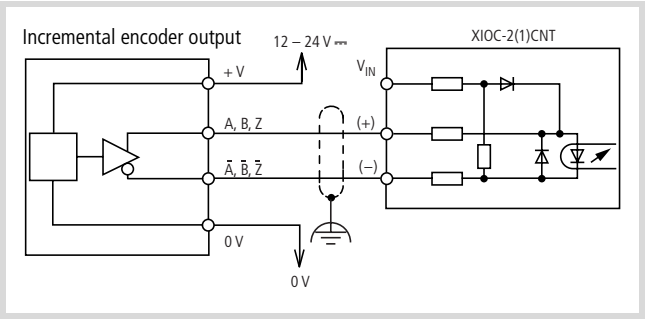


Figure 23: Connection for an incremental encoder with a differential output (example)

Incremental encoder with NPN transistor output

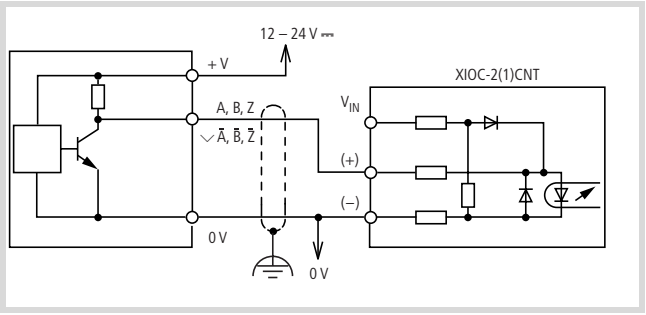


Figure 24: Connection for an incremental encoder with an NPN transistor output (example)

Incremental encoder with NPN transistor output (open-collector)

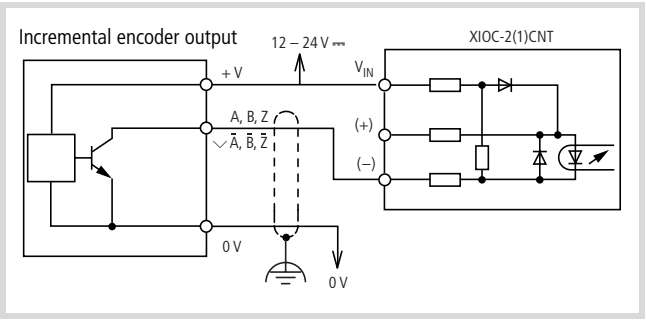


Figure 25: Connection for an incremental encoder with an open-collector NPN transistor output (example)

Incremental encoder with PNP transistor output (open-collector)

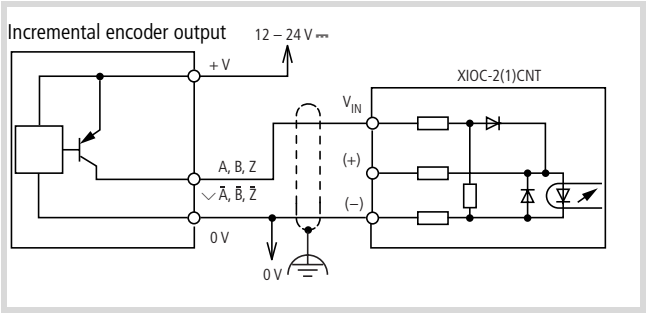


Figure 26: Connection for an incremental encoder with an open-collector PNP transistor output (example)

Connecting third-party equipment to the comparator output

The counter module has 2 open-collector transistor outputs per channel. The diagram shows how third-party equipment should be connected to the counter module.

Important!
Wire in a fuse (0.5 A) as shown in the diagram, to protect the internal circuitry

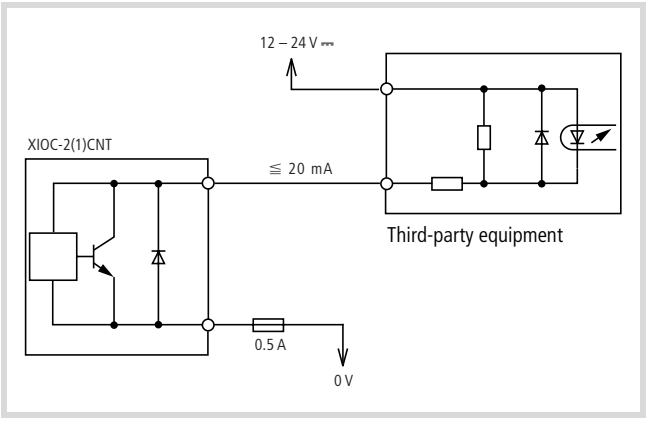


Figure 27: Connecting third-party equipment to the counter module

4 Technical data

XControl

General	
Standards and regulations	IEC/EN 61 131-2, EN 50 178
Ambient temperature	0 to +55 °C
Storage temperature	–25 to +70 °C
Vibration resistance	10 – 57 Hz ±0.075 mm, 57 – 150 Hz ±1.0 g
Mechanical shock resistance	15 g/11 ms
Impact resistance	500 g/∅ 50 mm ±25 g
Overvoltage category	II
Pollution degree	2
Protection class	1
Enclosure protection	IP20
Interference emission	DIN/EN 55 011/22, Class A
Electromagnetic compatibility	
Electrostatic discharge (IEC/EN 61 000-4-2)	
Contact discharge	4 kV
Radiated (IEC/EN 61 000-4-3, RFI)	
AM/PM	10 V/m
Burst (IEC/EN 61 000-4-4)	
Supply cables	2 kV
Signal cables	1 kV
Surge (IEC/EN 61 000-4-5)	
Supply cables, asymmetrical	0.5 kV
Conducted (IEC/EN 61 000-4-6)	
AM	10 V

Digital input modules

Type	XIOC-8DI	XIOC-16DI	XIOC-16DI-AC
Input type	DC input	DC input	AC input
Input voltage	24 V DC	24 V DC	200 to 40 V AC
Input voltage range	19.2 to 30 V DC	19.2 to 30 V DC	170 to 264 V AC
Input resistance	Typically 3.5 kΩ	Typ. 5.9 kΩ	Typ. 32 kΩ (50 Hz) Typ. 27 kΩ (60 Hz)
Input current	Typically 6.9 mA	Typ. 4.0 mA	4.3 to 8.0 mA (200 V AC/50 Hz)
Voltage level			
ON	≧ 15V	≧ 15V	≧ 164 V AC
OFF	≦ 5V	≦ 5V	≦ 40 V AC
Input signal delay			
OFF→ ON	≦ 5 ms (4 ms typ.)	≦ 5 ms (4 ms typ.)	≦ 15 ms
ON → OFF	≦ 5 ms (4 ms typ.)	≦ 5 ms (4 ms typ.)	≦ 25 ms
Number of input channels	8 channels/module	16 channels/module	16 channels/module
Number of channels with common reference potential	8 channels per reference potential 1)	16 channels per reference potential1)	16 channels per reference potential1)
Electrical isolation	Through optocouplers	Through optocouplers	Through optocouplers
Input indication	By LED (green)	By LED (green)	By LED (green)
External connection	Plug-in terminal block	Plug-in terminal block	Plug-in terminal block
Internal current consumption (5 V DC)	Typ. 26 mA	Typ. 51 mA	Typ. 51 mA
Weight	0.16 kg	0.16 kg	0.18 kg

1) The terminals for the reference potential are internally connected.

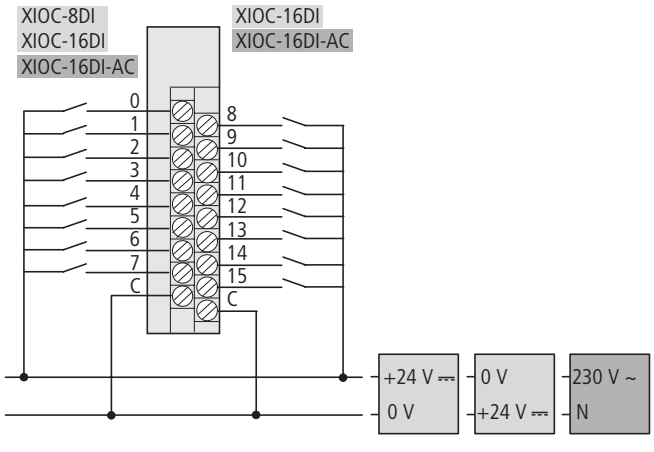


Figure 29: Terminal assignment

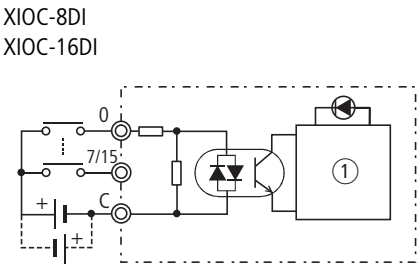


Figure 28: Internal circuit

① Internal circuitry

Digital output modules

Transistor output modules

Type	XIOC-8DO	XIOC-16DO	XIOC-16DO-S
Output type	Transistor output (source type)	Transistor output (source type)	Transistor output (source type)
Output voltage	12/24 V DC (+20 %, –15 %)	12/24 V DC (+20 %, –15 %)	12/24 V DC (+20 %, –15 %)
Switching current, minimum	1 mA	1 mA	1 mA
Leakage current	0.1 mA	0.1 mA	0.1 mA
Maximum load current			
Per circuit	0.3 A	0.3 A	0.8 A
Per common potential terminal	2.4 A	4 A	5 A
Output signal delay			
OFF→ ON	≦ 0.3 ms	≦ 0.3 ms	≦ 0.3 ms
ON → OFF	≦ 1 ms	≦ 1 ms	≦ 1 ms
Number of output channels	8 channels/module	16 channels/module	16 channels/module
Number of channels with common reference potential	8	16	16
Overvoltage protection	Diode	Diode	Integrated
Fuse[1)]	4 A	8 A	None
Electrical isolation	Through optocouplers	Through optocouplers	Through optocouplers
Output indication	By LED (green)	By LED (green)	By LED (green)
External connection	Plug-in terminal block	Plug-in terminal block	Plug-in terminal block
Internal current consumption (5 V DC)	Typ. 30 mA	Typ. 50 mA	Typ. 50 mA
External supply voltage[2)]	12/24 V DC (+20 %, –15 %); max. 30 mA[3)]	12/24 V DC (+20 %, –15 %); max. 30 mA[3)]	12/24 V DC (+20 %, –15 %); max. 30 mA[3)]
Weight	0.16 kg	0.16 kg	0.16 kg
Short-circuit protection	–	–	Yes

1) A blown fuse must not be replaced by the user.

2) Attach the external supply voltage (12/24 V DC) to the "C" and "S" terminals.

3) Internal current consumption of the module.

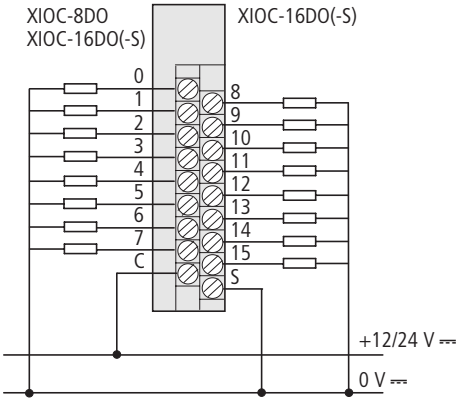


Figure 30: Terminal assignment

Relay output module

Type	XIOC-12DO-R
Output type	Relay output
Output voltage	100/240 V AC, 24 V DC
Switching current, minimum	1 mA
Maximum load current	
Per circuit	2A
Per common potential terminal	5 A
Output signal delay	
OFF→ ON	≦ 10 ms
ON → OFF	≦ 10 ms
Number of output channels	12 channels/module
Number of channels with common reference potential	12 channels per reference potential[1)]
Overvoltage protection	External
Fuse	External
Electrical isolation	Through optocouplers
Output indication	By LED (green)
External connection	Plug-in terminal block
Internal current consumption (5 V DC)	Typ. 40 mA
External applied voltage[2)] (for relay operation)	24 V DC (+20 %, –15 %) (max. 70 mA)
Weight	0.2 kg

1) The reference potential terminals are internally connected.

2) An external 24 V DC voltage must applied.

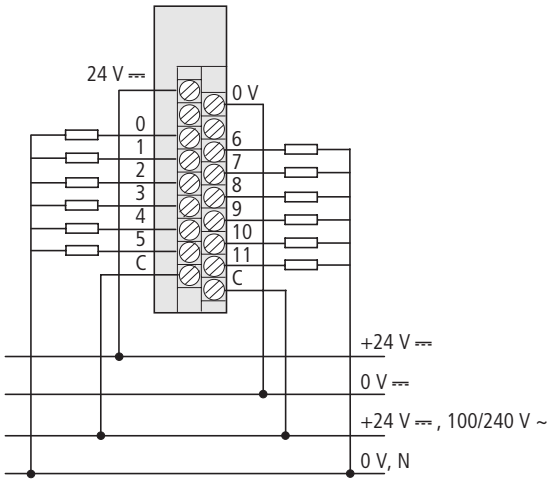


Figure 31: Terminal assignment for the XIOC-12DO-R module

Analogue input modules

Type	XIOC-8AI-I2	XIOC-8AI-U1	XIOC-8AI-U2
Input current range (0 to 7 channels)	4 to 20 mA	–	–
Input voltage range	–	0 to 10 V DC	–10 to 10 V DC
Resolution	12 bit	12 bit	12 bit
Conversion time	≦ 5 ms	≦ 5 ms	≦ 5 ms
Overall accuracy	≦ ±1 % (of end of scale)	≦ ±1 % (of end of scale)	≦ ±1 % (of end of scale)
Input resistance	–		
Voltage input	–	100 kΩ	100 kΩ
Current input	Typ. 100 Ω	–	–
Electrical isolation			
Channel to internal circuitry	Through optocouplers	Through optocouplers	Through optocouplers
Channel to channel	–	–	–
Number of channels	8	8	8
External connection	Plug-in terminal block	Plug-in terminal block	Plug-in terminal block
Internal current consumption (5 V DC)	100 mA	100 mA	100 mA
External supply voltage	24 V DC (+20 %, –15 %), approx. 0.15 A (approx. 0.4 A with supply switched on)		
External cabling	2-core shielded cable (≦ 20 m)		
Weight	0.18 kg	0.18 kg	0.18 kg

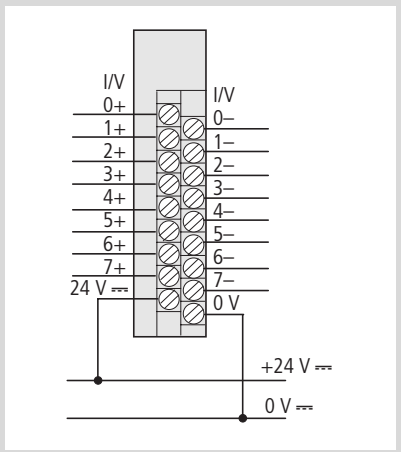


Figure 32: Terminal assignments for modules XIOC-8AI-I2 and XIOC-8AI-U1/-U2

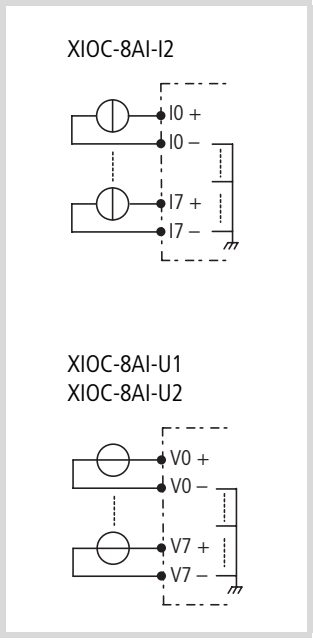


Figure 33: Module wiring

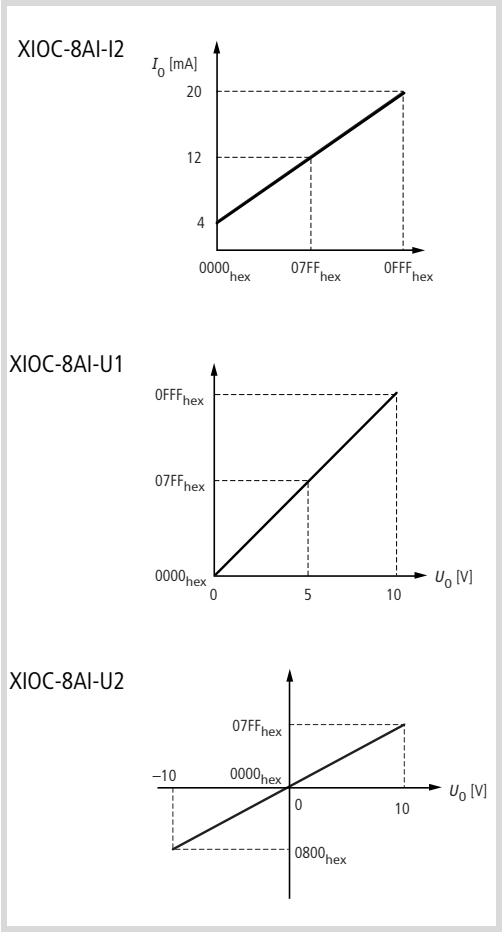


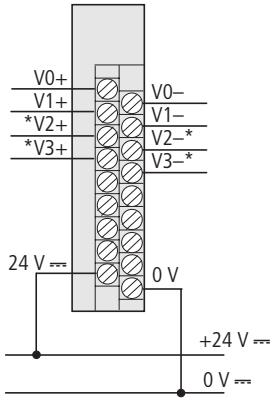
Figure 34: V/I diagram for the modules

Analogue output module

Type	XIOC-2AO-U1-2AO-I2	XIOC-2AO-U2	XIOC-4AO-U1	XIOC-4AO-U2
Output voltage range	0 to 10 V DC	–10 to 10 V DC	0 to 10 V DC	–10 to 10 V DC
Output current range	4 to 20 mA	–	–	–
Resolution	12 bit	12 bit	12 bit	12 bit
Conversion time	≦ 5 ms	≦ 5 ms	≦ 5 ms	≦ 5 ms
Overall accuracy	≦ ±1 % (of end of scale)			
External load resistance				
Voltage output	≧10k Ω	≧10k Ω	≧ 10 kΩ	≧ 10 kΩ
Current output	0 to 500 Ω	–	–	–
Electrical isolation				
Channel to internal circuitry	Through optocouplers	Through optocouplers	Through optocouplers	Through optocouplers
Channel to channel	–	–	–	–
Number of channels				
Output voltage[1)]	2 channels (0 to 1)	2	4	4
Output current[1)]	2 channels (2 to 3)	–	–	–
External connection	Plug-in terminal block			
Internal current consumption (5 V DC)	Typ. 100 mA	Typ. 100 mA	Typ. 100 mA	Typ. 100 mA
External supply voltage	24 V DC (+20 %, –15 %), approx. 0.15 A (approx. 0.5 A with supply switched on)			
External cabling	2-core shielded cable (≦ 20 m)			
Weight	0.18 kg	0.18 kg	0.18 kg	0.18 kg

1) On the XIOC-2AO-U1-2AO-I2, the current and voltage outputs can be used at the same time.

XIOC-2AO-U2
XIOC-4AO-U1/-U2



XIOC-2AO-U1-2AO-I2

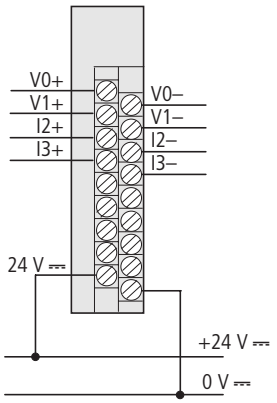
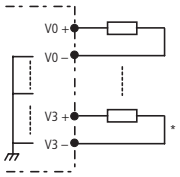


Figure 35: Terminal assignment

* not for XIOC-2AO-U2

XIOC-2AO-U2
XIOC-4AO-U1/-U2



* not for XIOC-2AO-U2

XIOC-2AO-U1-2A0-I2

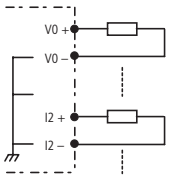
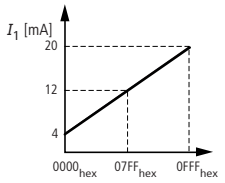
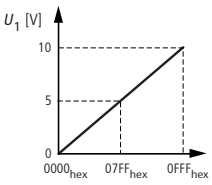


Figure 36: Module wiring

XIOC-2AO-U1-2A0-I2



XIOC-2AO-U1-2A0-I2
XIOC-4AO-U1



XIOC-2AO-U2
XIOC-4AO-U2

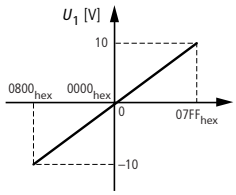


Figure 37: U/I diagram for the modules

Temperature acquisition module

→ More information on the temperature acquisition module can be found in Chapter 2 from Page 15 onwards.

Type	XIOC-4T-PT
Platinum RTD	Pt100 (IEC 751) / Pt1000
Temperature resolution	15 bit, with sign
Accuracy[1)]	
–20 to 40 °C (Pt100)	±0.5 °C
–50 to 400 °C (Pt100)	±3 °C
–50 to 400 °C (Pt1000)	±6 °C
Temperature measurement range	–20 to +40 °C / –50 to +400 °C (constant current 2 mA)
Number of inputs	4
Conversion time	Typ. 1 second for 4 channels
Electrical isolation	
Between inputs and the I/O bus	Through optocoupler
Between inputs	–
External supply voltage	24 V DC
Internal current consumption	Max. 200 mA
External resistance	Max. 400 Ω/channel
External cabling	Shielded cable
Additional functions	Linearisation
Fault detection –20 to +40 °C –50 to +400 °C	The resistance value is $7FFF_{hex}$ at: ≦ –25 °C or ≧ 45 °C ≦ –60 °C or ≧ 410 °C
Response to cable break or unused inputs	In this case, the resistance is $7FFF_{hex}$.
Weight	0.18 kg

1) The quoted accuracy applies after 10 minutes of operation. The maximum temperature deviation can be somewhat larger just after the start. The characteristics of the RTD resistor must also be checked for correctness.

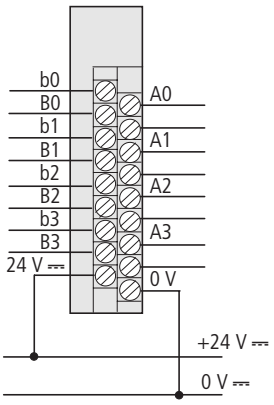


Figure 39: Terminal assignments for module XIOC-4T-PT

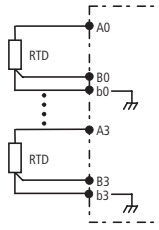


Figure 38: Module wiring

Counter module

→ More information on wiring up the counter module can be found in Chapter 3 from Page 21.

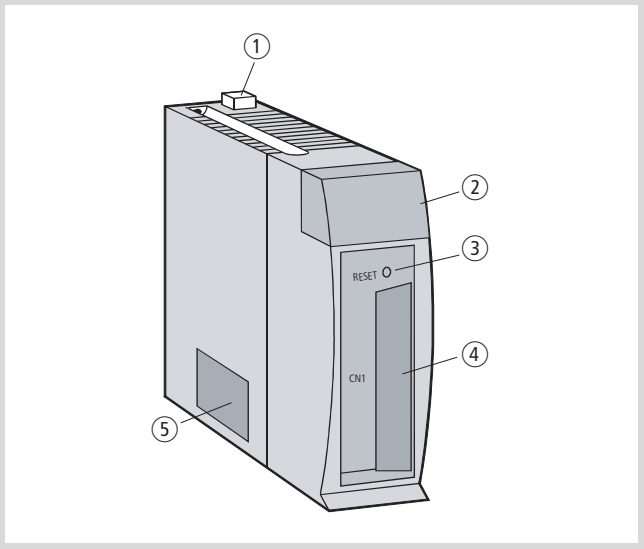


Figure 40: Assembly of the counter module

No.	Designation	Comments
①	Catch	
②	LED display	
③	Reset button	This is used if a hardware error is generated by the module. Note: After switching on the supply voltage, pressing the reset button will make the ER-LED light up.
④	Connection for external cabling	30-pole connection (15 pins × 2) for the XIOC-TERM30-CNT4 connector
⑤	Mode switch (DIP)	This switch is used to set the operating mode. Switch off the supply power and then detach the module before setting the DIP switch.

Mode (operating mode) switch

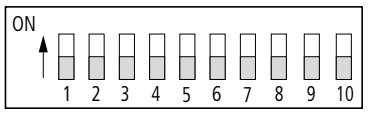
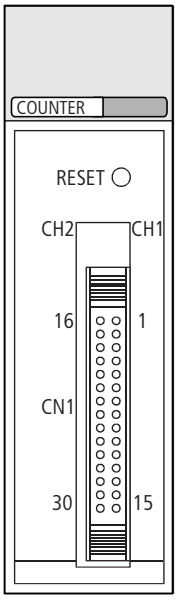


Figure 41: Mode (operating mode) switch, settings as delivered

Mode	Switch	Position	Function	Channel
Type of counter input				
1.1	1	OFF	2-phase counter, max. 100 kHz	1 + 2
	2	OFF		
1.2	1	ON	1-phase counter, (pulse-change)	1 + 2
	2	OFF		
1.3	1	OFF	1-phase counter, (polarity reversal)	1 + 2
	2	OFF		
1.4	1	ON	2-phase counter with 4x evaluation, max. 25 kHz	1 + 2
	2	ON		
Polarity of the marker input				
2	3/4	OFF	A voltage on the input produces a "0" signal	1/2
		ON	A voltage on the input produces a "1" signal	
CPU-stop → counter				
3	5/6	OFF	CPU-Stop → Counter Stop	1/2
		ON	CPU-Stop → Counter Run	
Linear/ring counter				
4	7/8	OFF	Linear Counter	1/2
		ON	Ring Counter	
–	9, 10	OFF	not used	–

Terminal assignment	No.	CH2	No.	CH1		Meaning of the signal
		XIOC-2CNT		**XIOC-2CNT/ XIOC-1CNT**		
	16	V_{IN} A	1	V_{IN} A	Phase A	If voltage input is used, connect to 12 to 24 V DC supply.
	17	A (+)	2	A (+)		If the differential input is used: connect to the positive polarity.
	18	A (–)	3	A (–)		If the voltage input is used, connect to the open-collector signal. If the differential input is used, connect to the negative polarity.
	19	V_{IN} B	4	V_{IN} B	Phase B	If voltage input is used, connect to 12 to 24 V DC supply.
	20	B (+)	5	B (+)		If the differential input is used: connect to the positive polarity.
	21	B (–)	6	B (–)		If the voltage input is used, connect to the open-collector signal. If the differential input is used, connect to the negative polarity.
	22	V_{IN} M	7	V_{IN} M	Marker	If voltage input is used, connect to 12 to 24 V DC supply.
	23	M (+)	8	M (+)		If the differential input is used: connect to the positive polarity.
	24	M (–)	9	M (–)		If the voltage input is used, connect to the open-collector signal. If the differential input is used, connect to the negative polarity.
	25 to 27	not used	10 to 12	not used		Do not connect anything to these terminals.
	28	Y2	13	Y0	Output	Comparator output
	29	Y3	14	Y1		
	30	Com2	15	Com1		(–) Reference potential for the comparator output. For XIOC-2CNT : reference potentials 1 and 2 are independent.

Note: The pin numbers defined for the XIOC-1CNT-100 kHz and XIOC-2CNT-100 kHz do not match those given by the connector manufacturer.

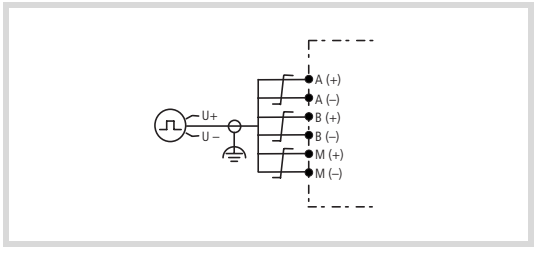


Figure 42: Encoder with differential outputs

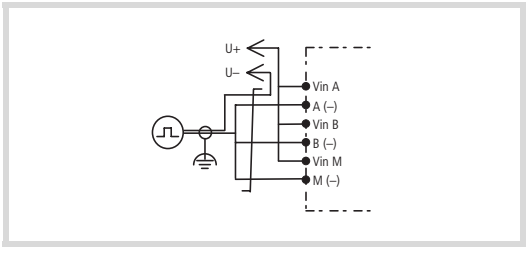


Figure 43: Encoder with voltage outputs

General technical data for the counter

Type	XIOC-2CNT-100 kHz	XIOC-1CNT-100 kHz
Electrical isolation	250 V DC between I/O signal and bus	250 V DC between I/O signal and bus
Internal current consumption (5 V DC)	200 mA	200 mA
Ambient temperature + humidity in operation	0 to 55 °C, 20 to 90 % relative humidity (no condensation)	
Ambient temperature + humidity in storage	–10 to 75 °C, 10 to 90 % relative humidity (no condensation)	
Input		
Maximum count value	32 bit (0 to 4,294,967,295)	32 bit (0 to 4,294,967,295)
Maximum frequency	100 kHz (25 kHz with 4x resolution)	100 kHz (25 kHz with 4x resolution)
Number of channels	2 channels	1 channel
Differential input current	≧ 4 mA	≧ 4 mA
Differential input voltage	12 to 24 V DC	12 to 24 V DC
Minimum ON voltage level	10 V DC	10 V DC
Maximum OFF voltage level	4 V DC	4 V DC
Electrical isolation	Through optocoupler	Through optocoupler
Number of inputs per channel	3	3
Minimum width of count pulse	ON: ≧ 4 µs, OFF: ≧ 4 µs	ON: ≧ 4 µs, OFF: ≧ 4 µs
Minimum width of marker	≧ 10 µs (during an ON transition)	≧ 10 µs (during an ON transition)
Connection for external cabling	30-pole connector XIOC-TERM30-CNT4	30-pole connector XIOC-TERM30-CNT4
External cabling	Twisted pair, shielded	Twisted pair, shielded
Output		
Type of output	Transistor (open collector)	Transistor (open collector)
External voltage	12/24 V DC (max. 30 V DC)	12/24 V DC (max. 30 V DC)
Minimum load current	1 mA	1 mA
Maximum load current	20 mA per output	20 mA per output
Leakage current	Max. 0.5 mA	Max. 0.5 mA
Output delay time		
ON → OFF	≦ 1 ms	≦ 1 ms
OFF→ ON	≦ 1 ms	≦ 1 ms
Votlage drop in ON state	Max. 1.5 V	Max. 1.5 V
Number of external outputs	4 outputs per module	2 outputs per module
Up/down counter	Actual (process) value ≧ setpoint 1	Actual (process) value ≧ setpoint 1
Ring counter	Actual (process) value = setpoint 2	Actual (process) value = setpoint 2
Electrical isolation	Through optocouplers	Through optocouplers

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